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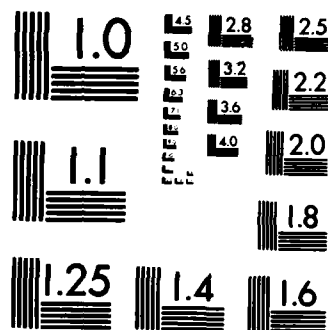
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RECRUITMENT AND SELECTION OF MINORITIES IN HIGH-TECH
ORGANIZATIONS: A SOCIOLOGICAL PERSPECTIVE

Jomills Henry Braddock II

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Recruitment and Selection of Minorities in High-Tech
Organizations: A Sociological Perspective

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September 1984

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Introduction

Despite recent gains in educational attainment, both blacks and women remain disproportionately underrepresented in professional, technical and managerial occupations. This pattern is particularly acute in fields such as engineering, mathematics and the hard sciences. In high-tech fields such as physics, engineering, aviation and the like blacks represent only a small fraction of their current proportional representation among all professional occupations. Recent tabulations by the U.S. Census Bureau (1980) show that while blacks hold 7 percent of all professional occupations in the civilian labor force, their distribution across detailed categories within this broad group is quite diverse. For example, although blacks comprise 10 percent of the elementary-secondary school teachers and 14 percent of the social workers they account for only 2 percent of the engineers and just 3 percent of the natural, mathematical and computer scientists.

Both social science explanations and conventional wisdom on the subject of minority maldistribution across professional and technical occupational categories have focused on supply-side factors--differences in individual resources or human capital such as educational attainment

and intelligence--as the primary determinants of minority and female underrepresentation in high-tech occupations. Despite voluminous research following this individual resource/free market tradition among sociologists using the "status attainment model" and among economists employing the "human capital model" our understanding of race, ethnic and gender differences in occupational attainment remains limited. Consequently, researchers are beginning to recognize the need to also consider systemic or structural processes operating on the demand-side of the labor market--e.g., employer recruitment practices and selection criteria--which may confront different population subgroups such as men and women or blacks and whites with different opportunity structures.

This chapter examines the research literature on career attainment processes to help us understand what factors have been most crucial in the recruitment and selection of minorities and women across a wide range of high-technology occupations and firms. The chapter is organized into three sections. First, following a brief definition of terms, recruitment and selection are considered as elements within a broad framework of career development. Second, a critical review of sociological research on career attainment is presented. Third, directions of emerging and needed research on this subject are discussed.

The term high-tech has many meanings, ranging from the

amorphous to the very specific. Both scientists and laypersons have used the term to (1) refer to societies undergoing advanced technological development whereby societal functions previously performed by human beings or by manually operated equipment become increasingly automated; (2) describe industrial sectors within a society with dense concentrations of advanced technological equipment used in the production of some particular service-- the military and national defense; the computer industry and information processing; or, the electronics industry and the production of basic and applied research which further advances technological development; and (3) characterize occupational groups whose skill requirements and routine tasks demand high and intense levels of involvement in developing and operating technologically advanced equipment.

Thus high-tech may refer to societies, industries and organizations, or occupations. Obviously, most industries or occupations in advanced technological societies such as Japan or the United States do not meet the criteria to be considered high-tech. Similarly, many jobs in high-tech industries such as electronics or computers would not qualify as high-tech occupations. For these reasons, and for conceptual clarity in this chapter, we focus on high-tech occupations as the most proximate and basic unit of analysis rather than organizations or societies. Even at this level, the research literature offers no clear or

specific definition. However, for the purposes at hand, we will define high-tech occupations in terms of their job tasks and skill requirements. Our conceptualization is derived from a complex job skills map based on Gottfredson's (1983) analysis of jobs listed in the Dictionary of Occupational Titles (DOT). Specifically, high-tech occupations, as we define them for this paper, include jobs which deal primarily with physical relations--mechanical or biological--and which require high or above average intelligence and high or above average spatial perception.

Table 1 lists selected DOT occupational titles which fall into our high-tech category. Distinctions between high-(e.g., engineers, chemists) and mid-level (e.g., drafters, lab technicians) jobs within this broad occupational classification are indicated in Table 1 (See Gottfredson, 1983; 1984 for a more detailed discussion of the job classification techniques on which our high-tech categories are based). Thus, this chapter attempts to address issues of recruitment and selection of minorities and women into these specific occupational groups in the U.S. regardless of the type of firm or industry in which the occupation may be located.

Table 1 about here

Recruitment, Selection and Career Development

The process whereby individuals select, and are at the same time selected, for particular occupations has long been a concern of sociologists. Recruitment, which is concerned with attracting persons into an occupation, may be viewed from two vantage points: (1) the individual choosing an occupation, and (2) the deliberate effort on the part of an occupation to draw recruits to the occupation (Pavalko, 1970). Although it is heuristically useful to distinguish between these two perspectives, in practice it is clear that both processes are interrelated. However, researchers have typically not considered both dimensions of occupational recruitment. Most career attainment research has focused almost exclusively on recruitment from the standpoint of the individual job-seeker, neglecting any serious consideration of the impact of employer recruitment-selection practices or other important labor market characteristics on career attainment processes.

Selection of the "most qualified," "most suitable," "most promising" candidate is perhaps the basic goal of every organizational official responsible for personnel hiring decisions. Employee selection decisions influence business growth, industrial productivity, and societal technological advancement. Selection decisions also have important social consequences regarding equity and fairness. In any selection procedure, there are two kinds of potential errors: selection of candidates who fail to perform up to standards, and rejection of candidates who could perform up

to standards if given the opportunity. Employers typically seek to avoid the first mistake but ordinarily have little interest in the second. Consequently, selection criteria that produce "overqualified" employees are quite acceptable even though many potentially qualified candidates may be rejected. Thus, the failure of research on individual career attainment processes to take into account employer selection procedures may have limited our understanding of differential occupational attainment among major population subgroups.

To better understand how various social and educational groups gain access to different employers and different establishments, we need to incorporate data on the structure of opportunities in organizations--e.g., recruitment and selection policies and practices--into previous models of individual career development. The assumption is that individual attributes and resources--which have been at the heart of most economic and sociological research on occupational attainment--interact with attributes and characteristics of organizations to produce different career outcomes among distinct population subgroups. Put differently, existing occupational inequalities may result not only from differences in human capital possessed by blacks and whites or men and women but also from differences in the structure of opportunities within organizations or labor markets or from some interaction between individual resources and opportunity structures.

To put the specific issues of minority recruitment and selection in high-tech organizations into broader perspective we next consider a hypothetical model of career development.

A Model of Career Development

Any organization that wants to increase the representation of minorities or women in high-technology fields must consider at what point(s) it can intervene most effectively in the recruitment-selection process. A typical pattern of organizational recruitment and selection of high-tech employees may be characterized by seven steps: (1) defining the pool of qualified individuals; (2) recruiting applicants; (3) screening out applicants who do not meet minimal qualifications; (4) selection of acceptable applicants; (5) persuading recruits to accept employment offers; (6) training recruits; and (7) graduating recruits from training into employment (See Figure 1).

Figure 1 about here

There are barriers at each of these stages which act as filters that reduce the flow in a pipeline of personnel, so that at stage 1 there may be thousands of college graduates, but at stage 7, any given corporation may find only a single female or minority nuclear physicist to fill its particular

employment needs.

Increasing the flow requires making one or more of the filters more porous--for example, by providing college scholarships for science majors (enlarging the candidate pool in stage 1), by advertising more widely or vigorously for candidates (stage 2), by changing the basic entry criterion from culturally bound general achievement test scores to minimum G.P.A.s or specific major fields (modifying the screening criteria at stage 3), increasing starting salaries or employee benefits (stage 5), developing a better training program so as to optimally utilize candidates with different types and levels of skills (stage 6), or using a less stringent, more accurate or multi-dimensional criterion, (e.g., grades, test scores, experience, and the like) for either selecting candidates for training (stage 4) or for granting a "diploma" and long-term employment at the end of training (stage 7).

In high-technology fields, the greatest barriers to minority and female recruitment are generally assumed to appear on the supply-side, at stage 1. High-technology jobs require advanced specialized training and education, and minorities often find themselves placed at a competitive disadvantage by an elementary and secondary education which did not prepare them for college science and math courses (Thomas, 1983). Or, in many cases, the appropriate college training is gender-typed--"masculine"--thereby requiring

women to assertively step out of traditional female fields of study to prepare themselves. For example, recent tabulations based on the Higher Education General Information Surveys of Degrees Conferred for 1980-81 indicate that there continues to be a supply problem in regard to the availability of minorities and women with college training in scientific and technical fields (Table 2). As these figures show black males and women of all race and ethnic backgrounds are underrepresented among recent college graduates earning degrees in science, mathematics, engineering and computer specialities (Trent, 1983). Interestingly, despite their relatively small absolute numbers, the pattern of scientific and technical majors among both Hispanic males and females more closely resembles the pattern for whites than does the pattern among blacks, especially males.

Table 2 about here

Employers can do little about these problems; but they do have some degree of control over other barriers that operate on the demand-side which limit the number of women and minorities at each of the other six stages. Table 3, which is based on data from a national Survey of Recent College Graduates-78, shows that both Hispanic and white college

graduates who earned degrees in scientific and technical fields are considerably more likely than similarly trained blacks to find employment in high-technology professions (56 % v. 40 % v. 28 % and 71 % v. 37 % v. 11 %, for Hispanic, white and black males and females, respectively).

Table 3 about here

Apparently, even those few blacks who earn degrees in scientific and technical fields may be confronted with access barriers or discrimination when seeking employment in high-tech occupations. Thus, a major focus of this paper will be on factors related on stages two through five in the career development model, where issues of organizational recruitment and selection are most crucial.

Where employers intervene in the process must be decided by an organizational cost/benefit analysis. Intervention is most effective at those stages where the largest number of candidates are lost. At each stage, there is a completion probability, defined as the number of candidates who complete the stage divided by the number who enter the stage. Analyses of completion rates of each stage often produce surprising results. Administrators often assume they lose candidates at one particular stage when in fact they may lose more at other stages. On the other side of the equation, intervention at different stages may increase

costs: for example, a higher advertising budget in stage 2, or taking a higher risk by selecting "nontraditional" (minority or women) trainees at stage 4.

Deciding which interventions in the system are most efficient depends upon knowing what characteristics of the individual or his environment are most related to completion of each stage. What personal traits pay off for an individual at each stage? What types of training programs have the highest completion rates? What form of selection procedure identifies the largest number of qualified applicants with the fewest errors? Questions of this nature are obviously important in understanding recruitment and selection from an organizational perspective. They are also important to our understanding of group variation in career attainment. Nevertheless, past research has generally neglected any systematic consideration of the importance of organizational, demand-side factors, thereby limiting our understanding of the career attainment process.

Research on Race and Career Attainment

Studies have consistently documented substantial differences in the distributions of black and white workers throughout the American labor force. Such differences have been noted both among the major occupational groups (Hodge and Hodge, 1965; Tauber, et al., 1966; Hodge, 1973; Masters, 1975; Featherman and Hauser, 1976) as well as within subcategories of the major occupational groups (Broom and

Glenn, 1967; Hare, 1965; Congressional Budget Office, 1977). Although trends over the past two decades indicate some convergence of the black and white occupational distributions, blacks continue to be overrepresented relative to whites in some occupational categories--typically lower-status--and similarly underrepresented in others--typically higher-status.

Differences in the occupational distributions of black and white workers affect income disparities between the races. A recent study conducted by the Congressional Budget Office (1977) demonstrated the importance of occupational classification in accounting for racial income gaps even after controlling for educational level, sex and region. That study concluded: "Before the large part of the overall (racial) income disparities are removed, the occupational distributions (of black and white workers), and particularly the distributions within the subcategories of the major occupational groups, must be equalized." The latter point has particular relevance for high-tech professions such as physics, engineering, aviation and the like where, as noted earlier, blacks represent only a small fraction of their current proportional representation among professional and technical fields. For example, research has shown that the financial payoffs at fixed levels of educational attainment are greater in scientific and technical "investigative" professions where blacks are underrepresented than in people-oriented "social"

professions such as education and social service where blacks are overrepresented (Gottfredson, 1978).

Research on occupational inequality falls into two broad categories: (1) studies which seek to describe the distribution of blacks and women across types or categories of occupations; and (2) studies which seek to explain the representation of minorities at different levels of occupational stratification system. Because this chapter is concerned with both the distribution of workers across high-tech occupations and with understanding the social processes which sort or channel individuals into different career paths, we will briefly review both types of studies.

Descriptive Studies of Occupational Differentiation

Three major research strategies have been employed in the descriptive studies: (1) Indexes of dissimilarity are used to compute summary measures for comparing the distributions of black and white workers across broad, or occasionally, detailed occupational groups (Hare, 1965; Broom and Glenn, 1967; Lieberman and Fuquitt, 1967; Glenn, 1968); (2) Black over- and under-representation is assessed across and/or within specific occupational categories by comparison to some a priori defined standard, i.e., the percentage of blacks in the total labor force, the percentage of white workers employed within the same occupational group, some "expected" percentage distribution of black workers within occupational groups, etc. (Duncan, 1968; Crain, 1970;

Congressional Budget Office, 1977; Braddock, et al., 1980); and, (3) Structural and individual level correlates of occupations, i.e., region, median income, prestige scores, industry, government employment, etc., are used in multiple regression models to predict the degree of black representation across detailed census occupational titles (Taeuber, et al., 1966; Snyder and Hudis, 1976). Although each of these strategies for measuring the extent and distribution of black participation in the labor force has its own set of advantages and disadvantages, their disparate nature often produces confusing if not conflicting evidence.

Causal Models of Occupational Attainment

Social scientists concerned with explaining race and gender variations in career attainments often represent two different perspectives: those who emphasize individual resources (the education, training and work skills held by different social groups); and those who focus on structural factors (the access to alternative employment opportunities by different social groups). But, with few exceptions, empirical studies of adult social status differences have concentrated on the individual resource factors alone; or, when individual and structural factors are included in the same model, the structural measures used have in most cases been based on crude classifications of census industry and occupation codes and provided only indirect indicators of differential labor market opportunities.

Sociological studies of the occupational attainment process have rarely included direct or detailed information on labor market processes or on the social relations in employment settings. For example, supply-side processes through which individuals search for jobs and demand-side processes through which employers locate and select new workers or promote current employees have typically not been part of the occupational attainment research. Nor has the typical occupational attainment study included information on the internal characteristics of employment settings, such as the degree of unionization, the use of on-the-job training, or the formalization of job ladders (Cf. Baron and Bielby, 1982; Blau, 1970; Gould, 1977; Stinchcombe, 1965). In addition, the research methodology in this tradition has not examined career mobility issues by using employment settings rather than individual workers as the unit of analysis--to inquire, for example, why some firms are more successful than others in developing a work force that is balanced by race and gender (Cf. Rossi et al., 1974; Sorensen and Tuma, 1981).

New research approaches and methodologies are needed to bring together the strengths of previous work on the variety of educational experiences and of earlier studies on the processes in different labor markets or employment settings. Only in this way can we expect to develop a more thorough and realistic analysis of the interaction of individual resources and labor market processes. Better data and more

precise model specification are needed on the alternative structures in local labor markets and firms that affect the processes through which educational attainments and other personal resources become translated into occupational careers, if we wish to directly test the validity of individual versus structural theories of adult occupational attainment outcomes.

Researchers have also attempted to study "discrimination" as a major explanation for the continuing race and gender gaps in occupational attainment. Most research on the concept of "discrimination" has been indirect, non-specific and static (McPartland and Crain, 1980). Studies estimating the extent to which discriminatory factors create major gaps in the attainments of blacks and whites have not used direct measures of discrimination at all; discrimination has usually been indirectly measured as the residual gap between the occupational success of blacks and whites after individual differences in job credentials or competencies and labor market locations have been statistically controlled (See, for example, Ashenfelter, 1972; Braddock, 1980; Duncan, 1969; Griliches and Mason, 1972; Jencks et al., 1972; Masters, 1975; Porter, 1974; Siegel, 1965; Weiss and Williamson, 1972; Welch, 1973; Wright, 1978).

Although these investigations have been conducted at a high level of technical sophistication and with increasingly thorough data, McPartland and Crain (1980) identify several

weaknesses in this type of research: (1) the likelihood that the research model is incompletely specified or relevant variables are omitted can lead to estimation errors regarding "race effects"; (2) discrimination is likely to be underestimated due to its potential effect on productivity resources in addition to any direct effect on labor market outcomes; (3) commonly used subgroup means substitution techniques are susceptible to biased estimates because the functional relationships of important predictor variables may vary across subgroups; (4) single group regression methods may be even more prone to error due to their insensitivity to within-subgroup productivity resource variability, and to differences in relative subgroup sample sizes; and (5) residual regression techniques shed little light on the character or mechanisms of discrimination.

Since these studies estimate the impact of discrimination without directly measuring the forms that discrimination may take, we do not learn about the specific barriers or different processes that minorities and women may face. To understand and evaluate how discrimination may operate, researchers need to specify and directly measure the separate processes that may constitute discrimination affecting women and minorities, including supply processes that inhibit candidates from appearing for employment opportunities as well as demand process that may exclude women and minorities when hiring decisions are made. Again, better data and more precise models are needed to

allow social science advances in theory and evidence on these topics.

New Directions in Research on Minority Career Processes

Some promising new research strategies and empirical evidence appear to address some of the research needs for studies of individual versus structural explanations of group variation in occupational attainment and for investigations of the variety of ways discrimination may play a role in career development processes.

First, several characteristics of firms, labor markets and communities which may potentially affect minority access to high-tech occupations are identified. Second, attention is focused on how specific aspects of the social structure of firms, labor markets and localities influence and are influenced by systemic social processes both within and outside the organization.

Firm and Labor Market Influences on Minority Recruitment in Organizations

Firm Characteristics

Although limited empirical research in either sociology or economics relates employer characteristics to the occupational attainment of minorities, recent evidence suggests that global characteristics of firms may influence both occupational allocation and wage attainment processes.

Size: A number of studies have related the racial or gender composition of an organization's work force to number of employees, total assets, share of the market, and other size-related characteristics. The results of these studies are mixed and inconclusive. Several studies have reported that large firms have more heterogeneous work forces--more women and blacks--than small firms (Braddock and McPartland, 1983; Thieblot and Fletcher, 1970; Bergman and Lyle, 1971; Schwartz, 1971; Lyle and Ross, 1973). Some studies find large firms have more homogeneous populations--few women and blacks (Sheperd, 1969; Flanders and Anderson, 1973; Mennerick, 1975) and other studies find no relationship between firm size and work force composition (Shepard and Levin, 1973). Szafran (1982) argues that these apparently contradictory results may be best understood in terms of the availability and use of discretionary funds. Larger firms are likely to have greater amounts of discretionary funds at their disposal. Some may elect to spend their funds to provide internal training programs and more extensive search procedures in order to increase the pool of blacks and women in the organization. Some firms may chose to pay higher wages to attract adequate numbers of white males, thereby maintaining the homogeneity of their organizational workforce; and still other firms may not have discretionary funds or may elect to use them in other ways. The way in which firms elect to utilize their discretionary resources may be, in large part, determined by political rather than

economic considerations (Szafran, 1982). Such political considerations might include extensive government contracts and pressures from equal employment agencies or interest groups concerned with minority hiring.

The evidence of the effect of firm size on workforce heterogeneity is unclear and the mechanisms through which its influence is manifest have not been clearly specified or measured primarily because of data inadequacies. Better data and more precise theories are required to determine how the size of an organization relates to the demographic composition of its work force.

Bureaucratization: Bureaucratization refers to the extent to which an organization's procedures are standardized and the extent to which rules, procedures, and instructions are documented (Stolzenberg, 1978). Bureaucratization provides an organization with the ability to decentralize decision-making while still maintaining control over the decisions which are made (Blau and Schoenherr, 1971). When organizations standardize and document their decision-making procedures they are not likely to include explicit references to race, sex, or other ascribed characteristics as criteria for either hiring or promotion (Szafran, 1982). Thus the use of discretionary power by hiring officials is limited by the formalization of the organization's personnel policies and procedures.

Mayhew (1968), for example, found that blacks were better represented in the work forces of organizations which utilized relatively formal recruitment procedures--e.g., advertising, employment services--than in organizations which depended upon informal word-of-mouth recruitment methods. The formalization of personnel practices also explains, in part, the tendency of large firms to have more heterogeneous work forces than small firms (Pfeffer, 1977; Thieblot and Fletcher, 1970; Hefner and Kidder, 1972; Schwartz, 1971).

Centralization: A related element of the bureaucratic social system of organizations is the degree of centralization. Centralization refers to the extent to which the locus of authority to make decisions is confined to higher levels of authority within the organizational hierarchy (Child, 1972). By identifying a specific unit within the organization with primary responsibility for personnel decisions, a firm does not insure that its hiring and promotion practices are nondiscriminatory but it does increase the likelihood that they will be impartial because arbitrary decision-making becomes more difficult to hide or defend.

Several studies have noted that the utilization of blacks was higher in organizations where most of the hiring decisions were made in a central office than in firms where those decisions were dispersed among various managers

(Mayhew, 1968; Anderson, 1970; Thieblot and Fletcher, 1970). As Mayhew (1968:68) points out: "When personnel decisions are delegated down the line, very subtle forms of prejudices and preferences operate to favor members of particular ethnic groups...and, consequently, to exclude (blacks)...bureaucratization is sometimes a precondition to programs of equal opportunity."

Labor Market Structures

The concept of labor markets refers to economic sectors in which employment, jobs, movement between jobs, and wages are similarly structured (Althauser and Kalleberg, 1981). Labor markets may refer to geographic, occupational, or industrial areas with interchangeable occupational structures and/or comparable wage levels.

Local labor markets: The opportunities for working in a particular type of job or for a particular kind of employer will vary by the local labor market in which a person resides. Different cities and localities will have different kinds of employment openings because of the geographic location of particular industries and establishments. Cities and localities will also have different levels of competition for particular jobs because of the labor supply characteristics of different places. Thus, to some degree, employment differences by race and educational level will be explained by the types of employers who are located in areas where different

population groups are concentrated. Empirical tests of alternative explanations of why specific social and educational groups are under- or over-represented in particular employment sectors and settings must statistically control for local area conditions of employment openings and labor supply.

Public v. private sector markets: Several studies have related the heterogeneity of an organization's work force to its location in the public versus private sectors of the economy (Braddock and McPartland, 1983; Brown, 1976; Johnson and Stafford, 1975). These studies show a consistent pattern of greater black and female participation in the public sector, but there are many possible explanations for this result. Iams (1976) suggests that the greater availability of discretionary resources in public sector organizations--being nonprofit and tax supported--permits them to operate in a manner consistent with prevailing government equal employment policies. Other factors besides discretionary resources--including the rate of growth, occupational distribution, absence of long-established unions, formalized recruitment and promotion criteria, centralized decision making, public visibility and their traditional commitment to equal employment opportunities--also affect the demographic composition of the work force in public sector organizations. Again, although the findings in this area are consistent, and the variety of explanations seem logical, they have not been

investigated thoroughly.

Internal v. external labor markets: Different employers depend upon different sources to locate and to train members of their work force in different job categories. Some firms will hire most of their workers from outside the establishment for both entry level positions and supervisory or senior level positions. These firms--which represent external labor markets--depend primarily upon the training and experience obtained by new employees from outside sources as the basis for the major skills needed to fill the job. Internal labor markets, on the other hand, exist in certain firms and occupational groups (such as unionized crafts) where workers tend to be promoted within the employing unit according to a routinized job ladder and without competition from outside the unit. These firms will promote from within to fill most of their needs above entry level positions, and depend largely on the training and experience received on the job within the establishment to produce the major competencies needed in their work force.

A firm's employee recruitment processes and selection criteria often relate closely to its practices of hiring from within or outside the establishment. For example, an employer with regularized training programs and internal career ladders within the firm is more likely to consider the promotion potential of entry level hires as a selection criteria and to use the recommendations of its other

employees in making hiring and advancement decisions. However, an employer who fills most positions with outside hires may develop specific selection criteria and tests for more job categories in its work force, and make more use of formal methods of recruiting workers, such as advertisements and employment services.

Summary

We believe that better data--direct measures of the labor market conditions and employment processes that affect different social and ethnic groups--are needed to generate more useful research on occupational attainment. A great deal may be learned about persisting occupational inequalities in American society by studying key processes used by different types of employers. To better understand how various minority groups gain access to different occupations and how they build successful careers within different establishments, we need to incorporate data on the structure of opportunities in local labor markets and firms into previous models of individual career attainment, and we need additional and improved research that employs the firm and the occupation rather than the individual as the unit of analysis.

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Table 1

Selected High-Tech Occupational Titles Using DOT Classification
by Type of Work and Skills Map Level

High (Level I)

Physical Sciences

Astronomer
Chemist
Computer-Applications Engineer
Environmental Analyst
Geodesist
Geologist
Hydrogolist
Metallurgist, Physical
Meterologist
Physicist

Life Sciences

Agronomist
Physical Anthropologist
Biochemist
Botanist
Dairy Technologist
Entomologist
Geneticist
Horticulturist
Pharmacologist
Soil Scientist

Medical Sciences

Anesthesiologist
Audiologist
Dentist
Internist
Ophthalmologist
Oral Surgeon
Radiologist

Mathematics and Statistics

Actuary
Engineering Analyst
Financial Analyst
Mathematical Technician
Programmer, Business

Engineering

Aerodynamist
Architect
Electrical Engineer
Health Physicist
Plant Engineer
Product-Safety Engineer
Tool Designer

Mid (Level II)

Managerial Work: Mechanical

Director, Quality Control
Manager, Bulk Plant
Mine Superintendent
Superintendent, Sanitation
Supervisor, Waterworks

Engineering Technology

Air-Traffic Control Specialist
Drafter, Aeronautical
Drafter, Automotive Design
Estimator
Flight Engineer
Inspector, Building
Land Surveyor
Potogrammetrist
Radiation Monitor
Transmitter Operator

Air and Water Vehicle Operation

Airplane Pilot
Check Pilot
Helicopter Pilot
Instructor, Flying 1
Master, Ship
Test Pilot

Laboratory Technology

Assayer
Cephalometric Analyst
Chemistry Technologist
Criminalist
Decontaminator
Film Laboratory Technician
Medical Technologist
Pilot-Control Operator
Quality Control Technician
Tester
Tissue Technologist
Weather Observer

Managerial Work: Plants and Animals

Animal Breeder
Cruiser
Field Contractor
Forester Aid
Manager, Dairy Farm
Superintendent, Production
Wildlife Control Agent

Figure 1

CAREER PROCESS STAGES

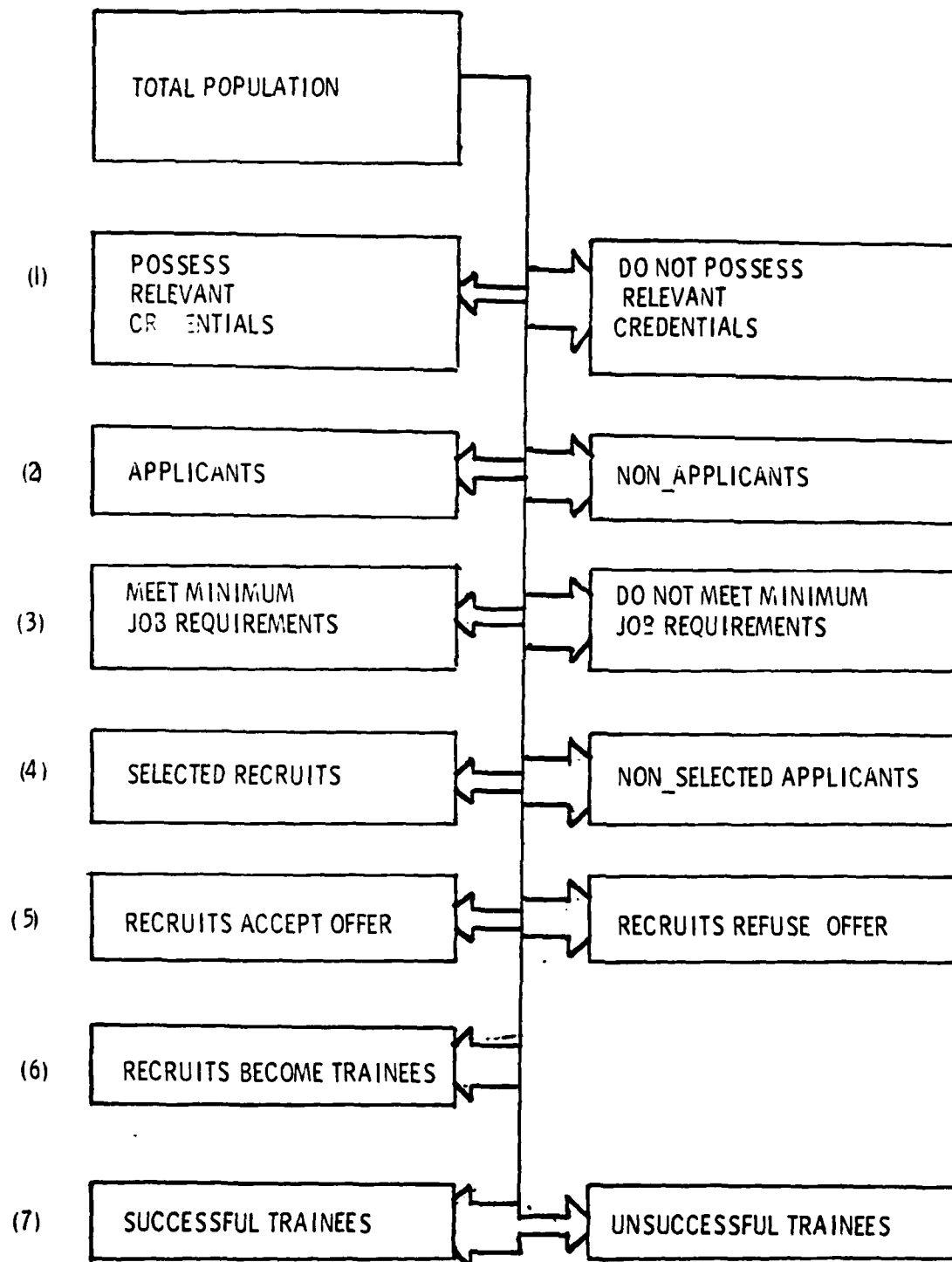


Table 2

Selected Major Field Distributions of Bachelors Degrees
Received in 1980-81 by Race, Ethnicity and Sex^a

Major Field	Males			Females		
	Blacks	Hispanics	Whites	Blacks	Hispanics	Whites
Biological Sciences	3.8	5.9	5.2	3.5	4.5	4.1
Computer Sciences	1.6	1.8	2.1	1.0	1.0	.9
Engineering	8.2	12.0	13.4	1.0	1.2	1.6
Mathematics	1.1	1.0	1.3	1.3	.6	1.0
Physical Sciences	2.5	2.7	4.0	.6	1.0	1.3
Scientific Subtotal	17.2	23.4	26.0	7.4	8.3	8.9
All other Fields	82.8	76.6	74.0	92.6	91.7	91.1
Total	100%	100%	100%	100%	100%	100%
N	24,511	10,810	406,185	36,162	11,023	395,256

^aSource: Retabulated from William T. Trent, Race and Sex Differences in Degree Attainment and Major Field Distributions From 1975-76 to 1980-81. Report No. 339, Center for Social Organization of Schools, Johns Hopkins University, Baltimore, Maryland, June, 1983.

Table 3

Percent of 1976-77 College Graduates With Scientific and
Technical Majors Who Are Employed in Selected
Occupational Categories by Race, Ethnicity and Sex^a

<u>Occupation</u>	<u>Males</u>			<u>Females</u>		
	<u>Blacks</u>	<u>Hispanics</u>	<u>Whites</u>	<u>Blacks</u>	<u>Hispanics</u>	<u>Whites</u>
High-Level Technical Occupations	28.3	44.4	35.3	6.6	71.1	17.7
Mid-Level Technical Occupations	--	11.2	4.9	4.9	--	19.4
Non-Technical Occupations	71.7	44.4	59.8	88.5	28.9	62.9
Total	100%	100%	100%	100%	100%	100%
N	6,414	1,741	116,354	1,542	272	31,260

^aSource: Survey of Recent College Graduates-'78. National Center for Education Statistics, Washington, D.C.

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